

Distribution and Abundance of the Northeastern Beach Tiger Beetle (*Habroscelimorpha dorsalis dorsalis*) (Coleoptera: Cicindelidae) at Eastern Shore of Virginia Sites in 2016

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ABSTRACT

A survey to determine the distribution and abundance of *Habroscelimorpha dorsalis dorsalis* (Say) at all known and potential sites on Virginia's Eastern Shore was conducted during their peak activity time in the summer of 2016 using the visual index count method. The survey found 25,844 adults at 35 sites. This compares with previous counts of 46,082 at 31 sites in 2009, 38,546 in 2005, 33,469 in 2002, and 32,143 in 1999. The decline in 2016 was a result of many of the sites having larger numbers in previous years and some other sites having lower counts. Sites with significantly lower counts were Church Neck North, Savage Neck, Tankards Beach, Scarborough Neck, Occohannock Neck, Parkers Marsh, and Hyslop Marsh. The only sites with significant increases from 2009 were Cape Charles South, Wilkins Beach, and Smith Beach. One new site was found in 2016, Hungars Beach with 125 adults. The causes of the significant decline in 2016 are uncertain, although shoreline recession as indicated by narrower beaches at numerous sites is believed to be a primary factor. Shoreline structures have been added at a number of sites and were associated with declines at some of these, but most of these sites also had low counts prior to 2009. It is uncertain if 2016 indicates a trend of decline or simply a low abundance year that might be followed by a rebound. Year-to-year variation in abundance is typical for this and other species of tiger beetles, and several years of significantly lower numbers like that observed in 2016 are needed to confirm a trend of decline.

Key words: conservation, shoreline armoring, shoreline recession, tiger beetles.

INTRODUCTION

Habroscelimorpha (= *Cicindela*) *dorsalis dorsalis* (Say) was listed as a Federally threatened species in 1990 because of the loss of the Northeastern populations (New Jersey to Massachusetts) and the current threats and lack of protection for many Chesapeake Bay sites (USFWS, 1994). Most significant was the loss of all known sites in New Jersey, New York (especially Long Island), Connecticut, and Rhode Island. The only current New England populations are one on Martha's Vineyard and another at Monomoy National Wildlife Refuge, the latter recently established by translocating larvae from the former. Since federal listing there have been increased surveys for new populations and monitoring of existing populations, most regularly in Maryland where the Calvert County populations have been surveyed every year since 1988. Currently, this beetle is widely distributed and relatively abundant along both shores of the

Chesapeake Bay in Virginia and three sites in Maryland (Knisley et al., 2016).

Earlier surveys of *H. d. dorsalis* in Virginia were conducted by the Virginia Department of Conservation and Recreation (Division of Natural Heritage) in 1989-1990 (Buhlmann & Pague, 1992). These surveys discovered many new sites along the eastern and western shorelines of the Chesapeake Bay, but population estimates were not accurate for some sites because they were not fully surveyed. Also, some portions of the Bay shoreline with potential habitat were not surveyed. Results from these and several other earlier surveys were included in the Northeastern Beach Tiger Beetle Recovery Plan (USFWS, 1994). Other survey results for selected sites are in Hill & Knisley (1994), Clark (1997), and Knisley (1997). Roble (1996) compiled the results of all of these earlier reports and some additional records through 1996. His report also includes a list of some potential sites that had not been surveyed.

Complete surveys of all known and potential new Virginia sites were initiated by the U. S. Fish and Wildlife Service in 1998 and continued at various intervals through 2016. The results of this survey of all sites along the western shoreline of the Chesapeake Bay are in Knisley et al. (1998). Results of surveys at all Maryland and Virginia sites through 2015 and the possible factors causing the trends are detailed in Knisley et al. (2016). This paper presents the results of adult surveys of all known Virginia Eastern Shore *H. d. dorsalis* sites in 2016 and is the first complete survey of this area since 2009 (Knisley, 2009). Comparison of these results with previous surveys and a discussion of factors that may explain these recent results are included.

METHODS

Two sites included in this study (Tangier Island and Saxis) were surveyed in July 2015, but all others were surveyed from 27 June to 18 July 2016. These dates are within the known period of peak seasonal activity for *H. d. dorsalis*. Weather conditions were favorable to optimal (sunny, temperatures 27 °C or higher, and light winds) on all survey days except one when a late afternoon developing storm and cooler temperatures occurred at one survey site. This site (Church Neck North) was resurveyed several days later. Surveys were conducted between 0930 and 1700 h and at low to mid-tide levels for most sites. Overall, survey conditions were appropriate for a high level of adult activity and peak abundance at the sites. The sites south of Elliotts Creek were accessed by land, all others by boat.

I conducted all surveys by walking the length of the shoreline at each site, looking ahead 10-15 m on the sand surface and counting all adult beetles seen within separate shoreline sections, most of which were several hundred meters in length. At sites where beetles were especially dense, I counted numbers as groups of 5 or 10 individuals. Total numbers per section were added to provide a total count for each site. Beach width and other shoreline or back beach features, including shoreline armoring structures for each of the sections surveyed, are not included here but are given in Knisley (2016) and Knisley et al. (2016). The survey results are discussed below and included in Table 1 and site locations provided in Fig. 1.

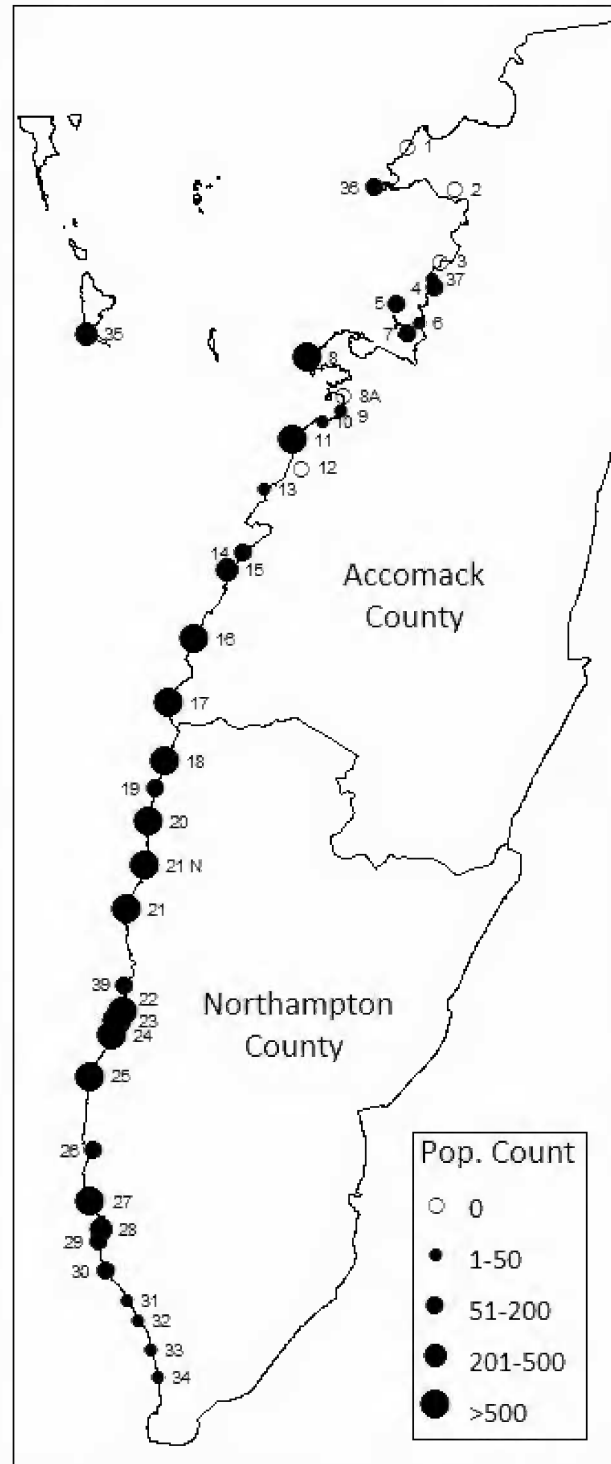


Fig. 1. Map showing all sites surveyed for *Habroscelimorpha d. dorsalis* on the Eastern Shore of Virginia in 2016. Solid dots indicate sites with one or more adults; open circles are sites with no adults.

RESULTS AND DISCUSSION

Overall Trends

The total count of adult *H. d. dorsalis* along the Virginia Eastern Shore in 2016 was 25,844 at 35 sites. This compares with the other complete survey totals of 46,082 at 31 sites in 2009, 38,546 at 35 sites in 2005, 33,469 at 33 sites in 2002, and 32,143 at 35 sites in 1999. The high count in 2009 was due to significant increases in several of the larger sites. In contrast, many of these same large sites and many others had lower counts in 2016, thus producing a lower total. Significantly lower counts in 2016 compared to 2009 were: Church Neck North (1,745 versus 7,979), Savage Neck (6,948 versus 9,657), Tankards Beach (2,270 versus 5,107), Scarborough Neck (2,705 versus 4,087), Occohannock Neck (1,013 versus 2,606), Parkers Marsh (767 versus 1,629), and Hyslop Marsh (898 versus 2,988). The only significant increases from 2009 were Cape Charles South (696 versus 194), Wilkins Beach (510 versus 59), and Smith Beach (632 versus 390). I found one new site in 2016, Hungars Beach with 125 adults.

Accounts of Individual Sites

Northernmost sites (1-9, 36, 37)

This group of natural, unarmored sites is comprised of small, marsh, and fragmentary beaches with relatively low numbers of *H. d. dorsalis*. None has any development activity and little or no apparent human impact except limited use by boaters. The total count for all nine sites was 1,354 compared to the second highest count of 1,664 in 2002 and a low of 449 in 2005. The northern range limit for *H. d. dorsalis* in the Chesapeake Bay is just to the north at Cedar and Janes Islands, Maryland where large populations are found on much larger marsh beaches. Saxis had small numbers of adults in 1999 and 2002 on a short, narrow beach section but none since. A 2015 larval survey that I conducted at this site yielded no larvae of *H. d. dorsalis* or even *Cicindela hirticollis* Say, this latter species being one that is much more tolerant of beach site disturbances. The beach was narrow (1-3 m) with very coarse sand and determined to be unsuitable for adults or larvae. There has also been erosion and beach narrowing in recent years. Long Point East had numbers (199) similar to the past two surveys but much lower than the nearly 600 in 2002. The south-facing shoreline where all of the beetles were found had very coarse sand indicating apparent significant erosion. Most adults were on the wider east beach section. Two sites in this section had significantly higher numbers

Table 1. Adult counts for *Habrosclimorpha d. dorsalis* at all Eastern Shore of Virginia survey sites in 2016 and previous years of complete surveys. Blank cells indicate no survey was conducted.

| Site # | Site Name | 2016 | 2009 | 2005 | 2004 | 2002 | 1999 |
|--------|-------------------------|---------------|---------------|---------------|-------------|---------------|---------------|
| 1 | Saxis Island | 0 | 0 | 0 | | 11 | 136 |
| 36 | Long Point East | 199 | 74 | 140 | | 598 | |
| 2 | Messongo Creek | | 0 | 4 | | 0 | 418 |
| 37 | Simpson Point | 9 | 5 | 122 | | 378 | |
| 3 | Cedar Island, Flood Pt. | 0 | 6 | 3 | | 2 | 43 |
| 4 | Frances Creek | 178 | 112 | 131 | | 401 | 179 |
| 5 | Half Moon Island | 55 | 101 | 3 | | 1 | 1 |
| 6 | Jacks Island, Sandy Pt. | 9 | 0 | 0 | | 0 | 2 |
| 7 | Webb Island | 138 | 0 | | | 0 | 5 |
| 8 | Beach Island | 766 | 636 | 46 | | 273 | 213 |
| 8A | Tobacco Island | 0 | | | | | |
| | 1-8 Totals | 1354 | 934 | 449 | | 1664 | 997 |
| 9 | Chesconessex South | 7 | 81 | 47 | | 49 | 4 |
| 10 | Back Creek | 28 | 130 | 162 | | 66 | 84 |
| 11 | Parkers Marsh | 767 | 1629 | 12554 | | 4587 | 3343 |
| 12 | Thickets Creek | 0 | 20 | 40 | | 28 | 12 |
| 13 | Parkers Island | 21 | 109 | 60 | | 1278 | 407 |
| 14 | Butcher Creek North | 193 | 418 | 531 | | 136 | 83 |
| 15 | Hacks Neck | 497 | 874 | 126 | | 662 | 751 |
| 16 | Hyslop Marsh | 898 | 2988 | 1954 | | 2424 | 640 |
| 17 | Scarborough Neck | 2705 | 4087 | 1789 | | 2996 | 1493 |
| | 9-17 Totals | 5116 | 10336 | 17263 | | 12226 | 6817 |
| 18 | Occohannock Neck N. | 1013 | 2606 | 1187 | | 1031 | 1537 |
| 19 | Battle Point S. | 103 | 520 | 65 | | 164 | 19 |
| 20 | Silver-Downings Beach | 1609 | 4417 | 1413 | 1232 | 2478 | 547 |
| 21N | Church Neck North | 1745 | 7979 | 2297 | | | |
| | north spit | | 343 | | | | |
| 21 | Church Neck | 2492 | 2678 | 1807 | | 2566 | 3384 |
| 39 | Hungars | 125 | | | | | |
| 22 | Smith Beach | 632 | 390 | 365 | | 113 | 307 |
| 23 | Wilkins Beach | 510 | 59 | 214 | | 667 | 1678 |
| 24 | Tankards Beach | 2270 | 5107 | 1248 | 975 | 1146 | 1791 |
| 25 | Savage Neck | 6948 | 9657 | 8619 | | 4375 | 7368 |
| | 18-25 Totals | 17447 | 33756 | 17215 | 2207 | 12540 | 16631 |
| 26 | Kings Creek | 173 | 535 | 751 | | 1247 | 176 |
| 27 | Cape Charles South | 696 | 194 | 1491 | | 2458 | 3452 |
| 28 | Elliot's Creek North | 397 | 145 | 85 | | 631 | 739 |
| 29 | Elliot's Creek South | 86 | 11 | 203 | | 425 | 204 |
| 30 | Picketts Harbor | 142 | 149 | 792 | | 2166 | 2412 |
| 31 | Butlers Bluff | 14 | 10 | 22 | | 30 | 245 |
| 32 | Kiptopeke State Park | 17 | 0 | 175 | | 37 | 301 |
| 33 | Latimer | 25 | 0 | 9 | | 10 | 51 |
| 34 | Wise Point | 46 | 12 | 43 | | 35 | 80 |
| 35 | Tangier Island | 331 | | 48 | | | 38 |
| | 26-35 Totals | 1927 | 1056 | 3619 | | 7039 | 7698 |
| | Grand Total | 25,844 | 46,082 | 38,546 | | 33,469 | 32,143 |

than in most previous years. Webb Island had 138 adults compared to only five in 1999 and none in other years. Beach Island had the highest ever count of 766 (261 on the south island) along the long, irregular sandy shoreline. The north part of the north island, with a count of 505 adults, had a relatively wide beach with fine sand and evidence of accretion at its north end. Simpson Point had only nine adults compared to five in 2009, and a peak of 378 in 2002. The decline may have been due to the observed shoreline narrowing. Tobacco Island, a new survey site, had no adults.

Northern Marsh Beaches (9-17)

This area includes nine sites, several small and others large, and all beaches backed by marshes. The overall count for all sites was 5,116, the lowest total of all previous surveys. All sites had lower counts than 2009, several less than half of the most recent counts. These sites include mostly natural beaches along the mainland with no shoreline armoring; only two sites had any development, both with a single house behind the beach. One of the most significant declines was at Parkers Marsh with a count of 767 compared to the previous low of 1,629 in 2009 and over 12,000 in 2005. The cause of the progressive decline at this site seems to be shoreline narrowing. Hyslop Marsh, a site with a beach physically similar to Parkers Marsh, also experienced a significant decline to 898 adults compared to near or over 2,000 in the three previous counts. Observations suggested that beach width was significantly narrower in 2016 than in 2009. Parkers Island had only 21 adults in 2016 compared to a peak of 1,278 in 2002. This low marsh island is apparently being lost to erosion/sea level rise because there was very little exposed sandy beach in 2016. Hacks Neck had the second lowest count (497) primarily due to a significant decline in numbers in the northeastern part of the site where the beach was noticeably narrower. In general, the decline in this area is probably a result of natural shoreline recession at many sites.

Middle Sites (18-25)

This section includes mostly large sites with large populations and significant sections of shoreline armoring at several sites, some of the armoring added since 2009. The total count of 17,447 for this section was similar to the 1999, 2002, and 2005 counts, but only about half of the 2009 count (33,756). Here also the cause of the decline seems to be shoreline recession. Occhohannock Neck numbers in 2016 (1,013) declined from the peak of 2,606 in 2009, but were similar to the previous low of 1,031 in 2002. This site has two new breakwaters in the northern third and two other new ones farther south. South of these latter two is a long section of unsuitable habitat with a seawall backed by houses and an access road. The road and houses have been added within the past decade. Battle Point South is armored with groins and seawall along most of its length. The count was 103 in 2016 compared to the significantly higher count of 520 in 2009; counts were near or less than 100 in other previous years. All adults were confined to two small beach areas between structures near the north end. All of the south end that had groins and a seawall with no exposed beach at mid

and high tide supported some adults in earlier years, but none in 2016.

The number of *H. d. dorsalis* at Silver-Downings Beach (1,609) was significantly lower than in 2009 but higher than three other years. The north section had several new breakwaters with arc beaches between them, and supported moderate numbers. The short, heavily used Camp Silver Beach had small numbers while the long natural beach to the south supported most of the population. South of here to the far end of the site is an unsuitable habitat section with houses, shoreline structures, and little or no exposed beach. The next sites to the south (Church Neck and Church Neck North) have long sections of natural, unarmored shoreline with very large *H. d. dorsalis* populations in previous surveys. Church Neck North had one of the largest declines compared to 2009 (over 8,000 to 1,745) while the Church Neck number (2,492) was similar to several recent counts. The cause of the decline at Church Neck North is uncertain. A portion of this site has houses several hundred meters behind the beach which probably accounts for the observed evidence of pedestrian beach use although it was minimal and without apparent impact on the habitat. In the past 10+ years there has been a progressive beach accretion at the south end that supports tiger beetles.

Savage Neck had the longest shoreline and highest count of any Eastern Shore site with both natural and armored shoreline. The total count of 6,948 included 1,448 in the north section (328 of these in a short section with three offshore breakwaters), 3,170 in the Virginia Department of Conservation and Recreation's Savage Neck Dunes Natural Area Preserve portion, and 2,330 in the south portion that included both armored and natural beach sections. Large numbers of beetles were also found in the three adjacent sites to the north: Tankards (2,270), Wilkins (510), and Smith Beach (632). Tankards continues to have a very wide beach backed by high cliffs with no shoreline structures and ideal habitat. Smith and Wilkins are fully armored with groins, bulkheads, and seawalls and have relatively narrow beaches backed by houses for their whole length. Despite this seemingly marginal or unsuitable habitat, the consistent presence of large numbers of adult beetles in all years suggests these sites may support successful larval development. It is also possible that many of the adults moved from the very large, dense populations to the south.

Southern Sites (26-35)

This section was distinct from other sections in having a higher count in 2016 (1,927) than 2009 (1,056). However, this increase was primarily a result

of large increases at Cape Charles South and Tangier Island. The two northern sites in this section are part of the Bay Creek development and receive a moderate amount of pedestrian beach use. The Kings Creek site along the mouth of Kings Creek had declining numbers for the past two surveys, (535 in 2009 and 173 in 2016 compared to 751 in 2005 and 1,247 in 2002). In 2016, most of the adults were north of the breakwaters section in the area of the creek mouth. The number at Cape Charles South increased from 194 in 2009 to 696 in 2016. This site had counts of 3,452 in 1999 and 1,491 in 2005 prior to the construction of eight breakwaters in the southern half of the site. The low count in 2009 and several subsequent years was believed to be a result of the use of heavy equipment for beach cleaning and maintenance. The significant increase in 2016 was considered to be a result of the cessation of this activity in 2015. Interesting, most of the adults in 2016 were in the breakwater section and very few to the north, unlike some of the earlier counts when many adults were in the northern half of the shoreline. This distribution and larval surveys indicate the population is utilizing the breakwater section of the site. The south end of this site at the mouth of Plantation Creek continues to change, but as in previous years includes sandy beach which supports moderate numbers of adults and apparently larvae.

Elliotts Creek North had a significantly higher count (397) in 2016 than in 2009 and 2005, but less than 2002 (631) and 1999 (739) when the shoreline was less armored. Of note is that 229 of the 2016 adults were in the unmodified sandy beach around the creek mouth. South of here was a long section of armoring, including breakwaters, groins, and rip rap. This armoring was present in 2005, but has increased since then. Other adults were near the south end in an arc beach between two spurs and within a very small beach on the north side of the mouth of Elliotts Creek. Elliotts Creek South yielded a count of 86 in 2016 as compared to only 11 in 2009, and several hundred in previous counts. The south end of the site includes rip rap and a narrow beach with no beetles. The middle to north end has an unarmored more natural beach where the adults occurred, especially the north end around the creek mouth.

Picketts Harbor includes a long section of shoreline that through 2002 supported a large population of over 1,000-2,000 adults in the earliest surveys. Numbers declined to 792 in 2005, 149 in 2009, and 142 in 2016. The long southern portion of the site with no armoring or apparent disruptions has supported most of the population, although many fewer than in earlier years. The northern half of the site has more disturbance, some structures, and evidence of continuing erosion and

had fewer adults (22) in 2016 than earlier years. Butlers Bluff, a site backed by high bluffs along most of its length had 14 adults in 2016 and similar low numbers since 1999 when the site had 245. The cause of the significant decline is likely shoreline erosion and associated impacts of the breakwaters and seawall/bulkhead along all but the northern end of the site. The far north end is unarmored but still has few adults. Breakwaters in the southern part of the site have wider beach but few adults. The middle sea-wall section is very eroded with much of the seawall overwashed and severely damaged. Kiptopeke State Park had only 17 adults in 2016 compared to 0 in 2009 and a peak of 301 in 1999. The establishment of the State Park resulted in heavy pedestrian use that is the probable cause of the decline in beetle numbers.

Latimer is a relatively long site backed by bluffs along its length. It had 25 adults in 2016 compared to none in 2009 and a peak of 51 in 1999. The site includes a narrow beach and thus mostly no or marginal habitat. Tangier Island was surveyed in 2015 and produced a total count of 331 adults. The count in 2005 was 48 adults, but this included only the main island and not Port Isobel where 280 adults were counted in 2015. The other 51 adults were found at the southeastern tip of the main island which had all 38 beetles counted in 1999.

Final Comments

The results of this survey indicate a significant decline in total numbers from the peak count in 2009 and from all previous surveys. The 2009 survey documented an apparent trend of increase from 1999 to 2009 (Knisley et al., 2016), but the 2016 results suggest a possible decline that could have been occurring after 2009. The causes of the decline in 2016 cannot be determined but the observed shoreline recession and increase in armoring at some sites are the likely causes. The increase and proportional amount of shoreline armoring and developments in the past 15-20 years has been much less than along the western shoreline of the Chesapeake Bay in Virginia where *H. d. dorsalis* numbers have declined much more significantly (Knisley et al., 2016). The eastern shore is much less developed, has more isolated sites, and is less likely than the western shoreline to be impacted from human activities and development. However, both shorelines are experiencing progressive shoreline recession and continued decline of populations of *H. d. dorsalis* throughout Virginia is a serious concern for the future of this species. It is also not certain if 2016 indicates a trend of decline or simply a low abundance year that will be followed by a rebound. Year-to-year variations

in abundance are typical for this and other species of tiger beetles, and several more years of lower numbers are needed to confirm a trend of decline.

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